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स्वचल वाहन – प्रतिवर्ती परावर्तक — विशिष्टि

(पहला पुनरीक्षण)

Indian Standard

AUTOMOTIVE VEHICLES — REFLEX REFLECTORS — SPECIFICATION

(First Revision)

UDC 629·113·018·38

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

November 1993 **Price Group 5**

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automative Accessories and Garage Equipment Sectional Committee, had been approved by the Transport Engineering Division Council.

This standard was originally published in 1976. In this revision, the Safety Standard followed by the industry has been referred to. Tests such as dust test, vibration test, shock test, damp heat test and cold test have been incorporated in this revised version.

Reflex reflectors being a safety item has also been included under Central Motor Vehicle Rules, as mandatory fitment for all motor vehicles.

For the preparation of this standard assistance has been drawn from the following publications.

JIS D 5500 : 1984 Lighting and signalling equipment for automobiles issued by the Japanese Industrial Standard (JIS)

SAE J 594 f Reflex reflectors, issued by the Society of Automotive Engineers, INC.

ECE Regulation No. 3 Uniform provision concerning the approval of safety reflecting devices for power driven vehicles and their trailers.

The committee responsible for the preparation of this standard is given in Annex A.

For the purpose of deciding, whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AUTOMOTIVE VEHICLES — REFLEX REFLECTORS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This Indian Standard covers the requirements for reflex reflectors for use on all automotives, including three wheelers, motorcycles, scooters and mopeds and their trailers. It includes recommended sizes, tests for colour and intensity of light and other tests applicable for quality and performance.

1.2 It also covers reflex reflectors moulded/assembled with other optical units like tail lamp, direction indicator etc. In case of reflex reflector assembled with other optical units, the reflector shall be tested separately.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard.

IS No.	*Title*
269 : 1989	Specification for 33 grade ordinary Portland cement (*fourth revision*)
1885 (Part 16/ Sec 1) : 1968	Electrotechnical vocabulary : Part 16 lighting, Section 1 General aspects
2500 (Part 1) : 1973	Sampling inspection tables : Part 1 Inspection by attributes and by count of defects (*first revision*)
9000 (Part 2/ Sec 1) : 1977	Basic environmental testing procedures for electronic and electrical items : Part 2 Cold test, Section 1 General
9000 (Part 2/ Sec 2) : 1977	Basic environmental testing procedures for electronic and electrical items : Part 2 Cold test, Section 2 Cold test for non-heat dissipating items with sudden change of temperature
9000 (Part 2/ Sec 3) : 1977	Basic environmental testing procedures for electronic and electrical items : Part 2 Cold test, Section 3 Cold test for non-heat dissipating items with gradual change of temperature
9000 (Part 2/ Sec 4) : 1977	Basic environmental testing procedures for electronic and electrical items : Part 2 Cold test, Section 4 Cold test for heat dissipating items with gradual change of temperature
9000 (Part 5/ Sec 1) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 5 Damp test, Section 1 16 + 8h cycle
9000 (Part 5/ Sec 2) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 5 Damp test, Section 2 12 + 12h cycle
9000 (Part 8) : 1981	Basic environmental testing procedures for electronic and electrical items : Part 8 Vibration (sinusoidal) test
10250 : 1982	Severities for environmental tests for automotive electrical equipment

3 DEFINITIONS

3.1 Reflex Reflection

Reflection in which light is reflected in directions close to the direction from which it came. This property is maintained over wide variations of the entrance angle.

3.2 Reflex Reflecting Optical Unit

A combination of optical components producing reflex reflection.

3.3 Reflex Reflecting Device (Reflex Reflector)

An assembly ready for use and comprising one or more reflex reflecting optical units.

3.4 Effective Reflex Surface

That part of the surface of a reflex reflecting device which is occupied by an assembly of reflex reflecting optical units and which appears continuous at the normal observation distances.

3.5 Reference Axis

The axis, as defined by the manufacturer of the reflex reflecting device, which serves as reference direction for the entrance angles in photometric measurements and in practical use. The reference axis usually corresponds to the axis of symmetry, if any, of the effective reflex surface.

3.6 Reference Centre

The orthogonal projection of the centre of gravity of the effective reflex surface on the plane nearest to the observer which is tangential to that surface and perpendicular to the reference axis of the reflex reflecting device.

3.7 Observation Angle

The angle between the straight lines connecting the reference centre to the centre of the receiver and to the centre of the source of illumination.

3.8 Entrance Angle

The angle between the reference axis and the straight line connecting the reference centre to the centre of the source of illumination.

3.9 Rotation Angle

The angle through which the reflex reflecting device is rotated about its reference axis starting from one given position.

3.10 Angular Subtense of the Reflex Reflecting Device

The angle subtended by the greatest dimension of the visible area of the effective reflex surface form a specified reference point.

3.11 Illumination at the Reflex Reflecting Device

The illumination measured at the reference centre in a plane perpendicular to the incident rays and passing through the reference centre.

3.12 Co-efficient of Luminous Intensity (*CIL*)

The value obtained by dividing the luminous intensity reflected in the direction considered by the illumination of the reflex reflecting device, for given observation, entrance and rotation angles.

3.13 Colour

The colour of the light reflected by the reflex reflector, defined in terms of its chromaticity co-ordinates, using the trichromatic system, in this system the colour is expressed in the chromaticity co-ordinates x, y and z, the sum of which is unity. The co-ordinate x is an indication of the proportion of red, y of the proportion of green and z of the proportion of blue.

3.14 Chromaticity

The colour quality of the light defined in terms of its chromaticity co-ordinates.

3.15 Uncoloured Light

White light reflected from the outer surface of reflex reflector.

3.16 Colour Temperature

The absolute temperature on the Kelvin scale (degrees K) of the source of a full radiation, the colour of which is as nearly as possible identical with the colour of a white light source. For testing reflex reflectors, a lamp with a filament operating at 2 856 degree K colour temperature, is recommended as source of illumination.

3.17 Symbols and Units Used (*See* Fig. 1)

A = Area of the effective reflex surface of the reflex reflecting device in square centimetres

C = Reference centre

NC = Reference axis

Rr = Receiver, observer or measuring device

Cr = Centre of receiver

ϕr = Diameter of receiver Rr, if circular, in centimetres

Se = Source of illumination

Cs = Centre of source of illumination

ϕs = Diameter of source of illumination in centimetres

De = Distance from centre Cs to centre C in metres (*see* Note)

$D'e$ = Distance from centre Cr to centre C in metres (*see* Note)

α = Observation angle

β = Entrance angle. With respect to the line Cs C which is always considered to be horizontal, this angle is prefixed with signs – (left), + (right), + (up) or – (down), according to the position of the source Se in relation to the axis NC, as seen when looking towards the reflex reflecting device. For any direction defined by two angles, vertical and horizontal, the vertical angle is always given first

γ = Angular subtense of the measuring device Rr as seen from point C

δ = Angular subtense of the source Se as seen from point C

ε = Rotation angle. This angle is positive when the rotation is clockwise as seen when looking towards the illuminated surface. If the reflex reflecting device is marked 'TOP', the position thus indicated is taken as the origin

E = Illumination of the reflex reflecting device (lux)

CIL = Coefficient of luminous intensity (millicandelas/lux)

All angles are expressed in degrees and minutes.

NOTE — De and $D'e$ are generally very nearly the same and under normal conditions of observation, it may be assumed that $De = D'e$. Furthermore, the effective distances may be used when a collimated system is used in order to obtain an artificially increased measuring distance.

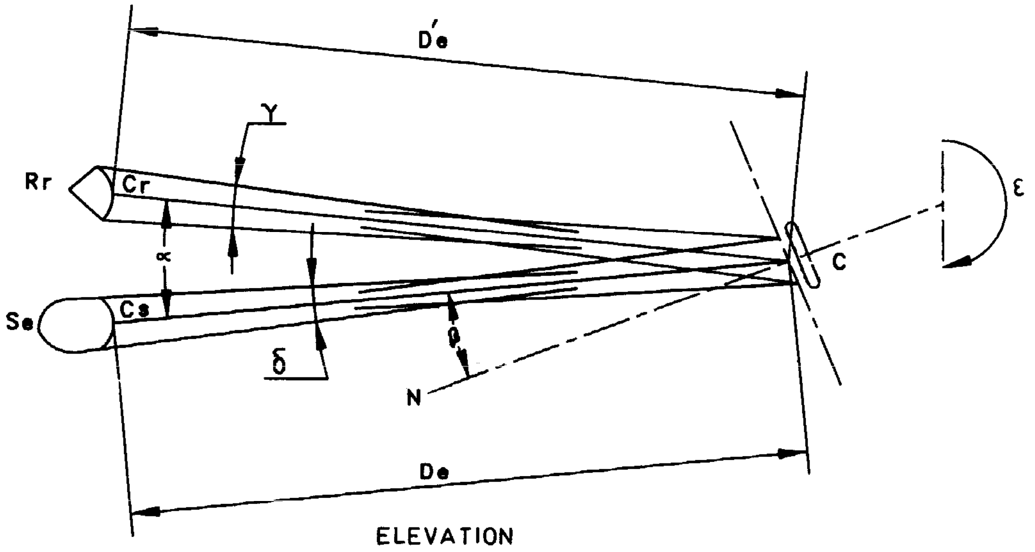


FIG. 1 EXPLANATORY DIAGRAM OF SYMBOLS USED

4 SHAPE AND DIMENSIONS

The shape and dimensions of reflex reflector may be as agreed to between the purchaser and the supplier with minimum reflecting surface as per statutory rules applicable for vehicles.

5 COLOUR

5.1 The colour shall be any of the following:

a) Red

b) Amber, or

c) White

6 COLORIMETRIC REQUIREMENTS

6.1 Reflex reflectors may consist of a combined reflex reflecting optical units and filter, which shall be so designed that they cannot be separated under normal conditions of use.

6.2 The colouring of reflex reflecting optical units and filters by means of paint or varnish is not permitted.

6.3 The colour limits of reflex reflectors when illuminated by *CIE* standard illuminant A [*see* **4.28** in IS 1885 (Part 16/Sec 1) : 1968] with an observation angle of $0^\circ\ 20'$ and an entrance angle $V = H = 0^\circ$, or if this produces an uncoloured surface reflection, an angle $V = \pm 5^\circ$, $H = 0^\circ$, shall be determined as specified in (a) or (b) below:

a) The trichromatic co-ordinates of the reflected luminous flux shall be within the following limits:

RED: Limit towards yellow $y = 0.335$
Limit towards purple $z = 0.008$

AMBER: Limit towards red $y = 0.398$
Limit towards yellow $y = 0.429$
Limit towards purple $z = 0.007$

or

b) RED : The colour shall have chromaticity co-ordinates which lie within the area formed by the straight lines defined by the pairs of points 1 and 2, 2 and 3, the spectrum locus, and the lines joining the ends of the spectrum locus.

Co-ordinate	*Point 1*	*Point 2*	*Point 3*
x	0.665	0.657	0.730
y	0.335	0.335	0.262

AMBER: The colour shall have chromaticity co-ordinates which lie within the area formed by the straight lines defined by the pairs of points 1 and 2, 2 and 3, and 3 and 4, and the spectrum locus.

Co-ordinates	*Point 1*	*Point 2*	*Point 3*	*Point 4*
x	0.570	0.564	0.595	0.602
y	0.429	0.429	0.398	0.398

Clear reflex reflectors shall not produce a selective reflection; that is to say, the trichromatic co-ordinates x and y of the standard illuminant A used to illuminate the device shall not undergo a change of more than 0.01 after reflection by the device.

7 PHOTOMETRIC REQUIREMENTS

7.1 For photometric measurements, 77.4 cm^2 *Max* illuminating surface shall be considered.

7.1.1 The test distance shall be 30.48 m.

NOTE — Test distance shall, as a rule, be 30.48 m. However, the measurement may be made at a distance other than 30.48 m when it is confirmed that the said distance does not affect the measurement result by comparing the test results obtained on both distances. In this case, however, size of the projector and size of the opening of photo-receiving part is appropriately selected to such test distance.

7.2 The *CIL* values for red reflex reflecting devices shall be at least equal to those given in Table 1 expressed in millicandelas per lux, for the observation and entrance angles shown.

7.2.1 *CIL* values lower than those shown in col 3 and 4 of Table 1 are not permissible within the solid angle having the reference centre as its apex and bounded by the planes intersecting along the following lines

$$(V \pm 10^\circ, H = 0^\circ), (V = \pm 5^\circ, H = \pm 20^\circ)$$

7.3 When the *CIL* of a reflex reflector is measured for an angle β of $V = H = 0^\circ$, it shall be ascertained whether any mirror effect is produced by slightly tilting the device. If there is any such effect, a reading shall be taken with an angle β of $V = \pm 5^\circ$, $H = 0^\circ$. The position adopted shall be that corresponding to the minimum *CIL* for one of these positions.

7.3.1 With an entrance angle of $V = H = 0^\circ$ or the angle specified in **7.3** and an observation angle of $0^\circ 20'$, a reflex reflector which is not marked 'TOP' shall be rotated about its reference axis to the position of minimum *CIL* which shall conform to the value specified in **7.2**. When the *CIL* is measured for the other entrance and observation angles, the reflex reflector shall be placed in the position corresponding to this value of $\in$. If the specified values are not attained, the device may be rotated about its reference axis $\pm 5^\circ$ from that position.

Table 1 Minimum Values of Coefficients of Luminous Intensity for Red Reflex Reflectors

(*Clauses* 7.2 *and* 7.2.1)

(*CIL* in millicandelas per lux)

Observation Angle α	**Entrance Angle** β		
	Vertical *V*		
	0°	$\pm 10^\circ$	$\pm 5^\circ$
	Horizontal *H*		
	0°	0°	$\pm 20^\circ$
(1)	(2)	(3)	(4)
	mcd/lx	mcd/lx	mcd/lx
$0^\circ 20'$	100	50	50
$1^\circ 30'$	5	2.5	2.5

7.3.2 With an entrance angle β of $V = H = 0^\circ$, or the angle specified in **7.3**, and an observation angle of $0^\circ 20'$, reflex reflectors marked 'TOP' shall be rotated about their axis $\pm 5^\circ$. The *CIL* shall not fall below the prescribed value in any position assumed by the device during this rotation.

7.3.3 If for the direction $V = H = 0^\circ$, and for $\in = 0^\circ$ the *CIL* exceeds the specified value by 50 percent or more, all measurements for all entrance and observation angles shall be made for $\in = 0^\circ$.

8 GENERAL REQUIREMENTS

8.1 The components of reflex reflectors shall not be capable of being easily dismantled.

8.2 The reflex reflector lens shall be free from harmful bubbles, wrinkles, strain, etc. There shall not be any bubbles with maximum diameter exceeding 2.5 mm.

8.3 Visual Inspection

A sample shall be located at the height equal to that of the head light (illuminating source) and shall be in the longitudinal centre line of the head light which is away from the driver's seat. The observation shall be made from the driver's seat. The reflector shall be checked with the mating (dip) beam in darkness at distances of 30 and 200 m. The head light shall be switched on and off and the reflection observed. The reflection (a flash of sparkling) shall be visible to the naked eye of the observer.

9 SAMPLING AND ACCEPTANCE CRITERIA

9.1 A recommended plan for acceptance tests and criterion for conformity is given in **9.1.1** to **9.1.3**.

9.1.1 If statistical quality control techniques have been used for production control such test results and relevant charts may be made available along with the material supplied to enable the purchaser to judge the acceptability or otherwise of a lot. In case such information is not available the following procedure is recommended for judging the conformity of a lot with the requirements of this specification.

9.1.2 *Scale of Sampling*

9.1.2.1 *Lot*

In any consignment, all the reflex reflectors of the same shape, size and colour and from the same batch of manufacture shall be grouped together to constitute a lot.

9.1.2.2 The number of reflex reflectors to be selected from a lot shall depend upon the lot size and shall be in accordance with col 1 and 2 of Table 2.

Table 2 Size of Sample and Criterion for Conformity
(*Clause* 9.1.2.2)

Lot Size *N* (1)	Sample Size *n* (2)	Permissible Number of Defectives (3)
51 to 150	5	0
151 to 300	13	1
301 to 500	20	1
501 to 1 000	32	2
1 001 and above	50	3

NOTE — For the lot size up to 50, the sample size and the permissible number of defectives shall be as agreed upon between the manufacturer and the purchaser.

9.1.2.3 These reflex reflectors shall be selected at random. In order to ensure randomness, the following procedure may be adopted.

> Arrange the reflex reflectors in a systematic manner and starting from any reflex reflector count them as 1, 2 .... etc, up to **r**, **r** being equal to the integral part of **N/n**, **N** being the lot size and **n** the sample size. Every **r**th reflex reflector shall be included in the sample.

9.1.3 *Number of Tests*

9.1.3.1 All the reflex reflectors selected under **9.1.2.2** shall be subjected to acceptance tests.

9.1.4 *Criterion for Conformity*

A lot shall be considered as conforming to this specification, if the number of reflex reflectors out of those tested failing to satisfy the requirements of any one or more of acceptance tests, does not exceed the corresponding numbers given in col 3 of Table 2.

9.1.5 When the reflex reflector has been tested and complies with the requirements for a red reflector, it may, by extension, be passed for other colours provided two sample reflectors of additional colour to be tested are submitted and satisfy the colorimetric requirements specified in **6**. In this case, the other test requirements need not be applied.

10 TESTS

10.1 Classification of Tests

10.1.1 *Type Test*

The following shall constitute type tests:

a) General requirements: Inspection (*see* **8**)

b) Shapes and dimensions: Inspection (*see* **4**)

c) Colorimetry: (*see* **6**)
Inspection
Trichromatic co-ordinates in case of doubt

d) Photometry: (*see* **7**)
Limited to observation angles of $0^\circ 20'$ and $V = H = 0^\circ$

e) Photometry: (*see* **7.2**)
At all test points on the devices giving maximum and minimum readings

f) Water penetration: (*see* **10.2**)
10 min in normal position
10 min in inverted position

g) Colorimetry: [*see* **10.1.2.3** (a)]
Inspection
Trichromatic. co-ordinates in case of doubt

h) Photometry: [*see* **10.1.2.3** (b)]
Limited to observation angle of $0^\circ 20'$ and $V = H = 0^\circ$

j) Fuel test: (*see* **10.4**)
For 5 min
Inspection

k) Oil test: (*see* **10.5**)
For 5 min
Inspection

m) Colorimetry [*see* **10.1.2.3** (a)]
Inspection
Trichromatic co-ordinates in case of doubt

n) Photometry: [*see* **10.1.2.3** (b)]
Limited to observation angle of $0^\circ 20'$ and $V = H = 0^\circ$

p) Dust test: (*see* **10.8**)

q) Vibration test: (*see* **10.9**)

r) Shock test: (*see* **10.10**)

s) Damp heat test: (*see* **10.11**)

t) Cold test: (*see* **10.12**)

u) Corrosion test: (*see* **10.3**)
For 24 hours
2 hours interval
For 24 hours
Inspection

v) Adhesion of reverse side: (*see* **10.6**)
For 1 min
Inspection

w) Resistance to heat: (*see* **10.7**)
For 12 hours at $70 + 3^\circ C$
Inspection for distortion

y) Colorimetry: [*see* **10.1.2.3** (a)]
Inspection
Trichromatic co-ordinates in case of doubt

z) Photometry: [*see* **10.1.2.3** (b)]
Limited to observation angles of $0^\circ 20'$ and $V = H = 0^\circ$

10.1.1.1 Chronological order of type tests shall be according to Table 3.

Table 3 Chronological Order of Type Tests

(*Clause* 10.1.1.1)

Test	Clause Reference	Typical Table of Tests on 12 Samples	
(1)	(2)	(3)	
General requirement: Inspection	8	x x x x x x	x x x x x x
Shapes and dimensions: Inspection	4	x x x x x x	x x x x x x
Colorimetry:	6		
Inspection		x x x x x x	x x x x x x
Trichromatic co-ordinates in case of doubt		x	
Photometry: Limited to observation angle of $0^\circ 20'$ and $V = H = 0^\circ$	7	x x x x x x	x x x x x x
Photometry: At all test points on the devices giving maximum and minimum readings	7.2	x x	
Water penetration:	10.2		
10 min in normal position			x x
10 min in inverted position			x x
Inspection			x x
Colorimetry:	10.1.2.3 (a)		
Inspection			x x
Trichromatic co-ordinates in case of doubt			x x
Photometry: Limited to observation: angles of $0^\circ 20'$ and $V = H = 0^\circ$	10.1.2.3 (b)		x x
Fuel test:	10.4		
For 5 min			x x
Inspection			x x
Oil test:	11.5		
For 5 min			x x
Inspection			x x
Colorimetry:	10.1.2.3 (a)		
Inspection			x x
Trichromatic co-ordinates in case of doubt			x x
Photometry: Limited to observation angles of $0^\circ 20'$ and $V = H = 0^\circ$	10.1.2.3 (b)		x x
Dust test	10.8		x x
Vibration test	10.9		x x
Shock test	10.10		x x
Damp heat test	10.11		x x
Cold test	10.12		x x
Corrosion test:	10.3		
For 24 hours		x	x
2 hours' interval		x	x
For 24 hours		x	x
Inspection		x	x
Adhesion of reverse side:	10.6		
For 1 min		x	x
Inspection		x	x
Resistance to heat:	10.7		
For 12 hours at 70 + 3°C		x	
Inspection for distortion		x	x
Colorimetry:	10.1.2.3 (a)		
Inspection		x	x
Trichromatic co-ordinates in case of doubt		x	x
Photometry:	10.1.2.3 (b)	x	x
Limited to observation angles of $0^\circ 20'$ and $V = H = 0^\circ$			x

10.1.2 *Type Test Procedure*

At least twelve samples shall be submitted for testing. These shall be tested in accordance with the procedure stated below. The testing authority shall issue a type approval certificate if the reflex reflectors are found to comply with the requirements of the tests given in **10.1.1**.

10.1.2.1 After verification of shape and dimensions and general requirements the samples shall be examined for colorimetric requirements and *CIL* (*see* **7**) for an observation angle of 0° 20' and an entrance angle $V = H = 0°$ or if necessary, in the position defined in **7.3**. The two reflex reflectors giving the minimum and maximum *CIL* values shall then be fully tested according to **7.2**. The other ten samples shall be divided into five groups, each containing two samples:

First group: The two samples shall be subjected to the water penetration test (*see* **10.2**).

Second group: The two samples shall be subjected to the corrosion test (*see* **10.3**) and then to adhesion test for the reverse side of reflex reflector (*see* **10.6**).

Third group: The two samples shall be subjected to dust test (*see* **10.8**), vibration test (*see* **10.9**) and shock test (*see* **10.10**).

Fourth group: The two samples shall be subjected to damp heat test (*see* **10.11**) and cold test (*see* **10.12**).

10.1.2.2 In the event of other tests being required, such as in cases of doubt regarding the tests on the above groups, the fifth group shall be subjected to such tests.

10.1.2.3 After undergoing the tests referred to in **10.1.2.1**, the reflex reflectors in each group shall have:

a) a colour which satisfies the conditions specified in **6**. This shall be verified by a qualitative method, and, in case of doubt confirmed by a quantitative method.

b) a *CIL*, which satisfies the conditions specified in **7**, which after the test, reaches at least 60 percent of the value previously obtained with the same sample. The tests shall be made only with an observation angle of 0° 20' and an entrance angle of $V = H = 0°$.

10.1.3 *Acceptance Tests*

The following shall constitute acceptance tests:

a) General requirements: Inspection (*see* **8**)

b) Shapes and dimensions: Inspection (*see* **4**)

c) Colorimetry: (*see* **6**)
Inspection
Trigonometric co-ordinates in case of doubt

d) Photometry: (*see* **7**)
Limited to observation angles of 0° 20' and $V = H = 0°$

10.1.4 *Routine Tests*

The following shall constitute the routine tests:

a) General requirements: Inspection (*see* **8**)

b) Shapes and dimensions: Inspection (*see* **4**)

10.2 Resistance to Penetration of Water

Reflex reflectors, whether part of a lamp unit or not, shall be stripped of all removable parts and immersed for 10 minutes in water at a temperature of 25 ± 5°C, the highest point of the upper part of the transmitting surface being not less than 20 mm below the surface of the water. This test shall be repeated after turning the reflex reflector through 180°, so that the transmitting surface is at the bottom and the reverse side covered by not less than 20 mm of water.

10.2.1 No water shall penetrate to the reflecting surface of the reflex reflecting optical unit; this shall be verified by inspection. If inspection reveals the presence of water, the device shall be considered not to comply with this standard.

10.2.2 If inspection does not reveal the presence of water, or in case of doubt the optical performance shall be checked as specified in **10.1.2.3**, after lightly shaking the reflex reflector to remove excess water from the outside.

10.3 Resistance to Corrosion

Reflex reflectors shall be so designed that they retain the prescribed photometric and colorimetric characteristics despite the humidity and corrosive influences to which they are normally exposed. The resistance of the front surface to tarnishing, and of the protective back surface to deterioration shall be checked, particularly when an essential metal component seems liable to be attacked.

10.3.1 The reflex reflector, or the lamp if the device is combined with a lamp, shall be stripped of all removable parts and the reflex reflector subjected to the action of a saline mist for 50 hours, comprising two periods of exposure of 24 hours each separated by an interval of 2 hours during which the sample is allowed to dry.

10.3.2 The saline mist shall be produced by atomizing, at a temperature of 35 ± 2 °C, a saline solution obtained by dissolving 20 ± 2 part by weights of sodium chloride in 80 parts of distilled water containing not more than 0.02 percent of impurities. Immediately after completion of the test, the sample shall not show signs of excessive corrosion liable to impair the efficiency of the device. The optical performance shall comply with **10.1.2.3**.

10.4 Resistance to Fuels

The outer surface of the reflex reflector and, in particular, the transmitting surface, shall be lightly wiped with a cotton cloth soaked in a mixture of petrol and benzene (proportion 90 : 10). After 5 minutes the surface shall be inspected. It shall not show any visible change.

10.5 Resistance to Lubricating Oils

The outer surface of the reflex reflector and in particular, the transmitting surface, shall be lightly wiped with cotton soaked in a detergent lubricating oil. After 5 minutes the surface shall be cleaned by washing in a detergent solution. The optical performance shall comply with **10.1.2.3.**

10.6 Test of Adhesion of the Accessible Reverse Side of Mirror Backed Reflex Reflectors

The reverse side of the reflex shall be brushed with a hard nylon brush and then thoroughly wetted with a mixture of petrol and benzene (proportion 90 : 10). After 1 minute, the mixture shall be removed and the device allowed to dry. As soon as evaporation is completed, the abrasion test shall be repeated by brushing the reverse side with a hard nylon brush. The reflex reflector shall comply with **10.1.2.3.**

10.7 Resistance to Heat

The reflex reflector shall be kept for one hour in a dry atmosphere at a temperature of 70 ± 3 °C.

10.7.1 After this test, cracking or appreciable distortion of the reflex reflecting device particularly of its optical units, shall be evident.

10.7.2 The optical performance shall be in accordance with **10.1.2.3.**

10.8 Dust Test

A sample unit shall be mounted in its normal operating position, at least 150 mm from the wall in a cubical box with the measurements of 900 to 1 200 mm on each side containing 5 kg of medium heat Portland cement according to IS 269 : 1989.

At an interval of 15 minutes, this dust shall be agitated by compressed air or from blower by projecting blasts of air for a 2 second period in a downward direction into the dust in such a way that the dust is completely and uniformly diffused throughout the entire cube. This test shall continue for 5 hours. After this test, the reflex reflector shall not have any harmful dust on the inside of the lens (effective reflecting surface). In case of doubt, the optical performance shall be checked as specified in **10.1.2.3.**

10.9 Vibration Test

10.9.1 This test is intended to determine the ability of reflex reflector to withstand specified severities of vibration when mounted on a vehicle.

10.9.2 The test shall be carried out as specified in IS 9000 (Part 8) : 1983 with the following severities:

Frequency range — 10 to 55 Hz,
Displacement amplitude — 0.75 mm, and
Total duration — Three hours

10.9.3 The reflex reflector shall then comply with the performance requirement as specified in **10.1.2.3.**

10.10 Shock Test

The reflector shall be mounted on the anvil end of the table of the shock test machine in a manner similar to the mounting in actual use. The sample shall then be subjected to shock at a rate of 750 times per minute through a cam action of 3.2 mm. The table shall be spring mounted at one end and fitted with steel calks on the other side of other end. These calks are made to contact with the steel anvil once during each cycle of completion of the fall. The rack shall be operated under spring tension of 265N to 314 N. This test shall be continued for one hour. Any unit showing rotation of lens, cracking or rupture of parts,etc, shall be considered to have failed. Rotation of reflex reflector shall not be considered as a failure when tests show compliance with other specification. A typical shock test machine is shown in Fig. 2.

10.11 Damp Heat (Cycling) Test

10.11.1 This test is intended to check the satisfactory performance level (*see* **10.1.2.3**) that can be maintained before and after exposure to varying conditions of humidity and temperature.

10.11.2 The test shall be carried out according to group 2 of IS 10250 : 1982.

10.11.3 Number of conditioning cycles and recovery period shall be as follows:

Number of cycles	7
Recovery period, hours	24

10.11.4 After the test, reflex reflector shall comply with the performance requirements specified in **10.1.2.3.**

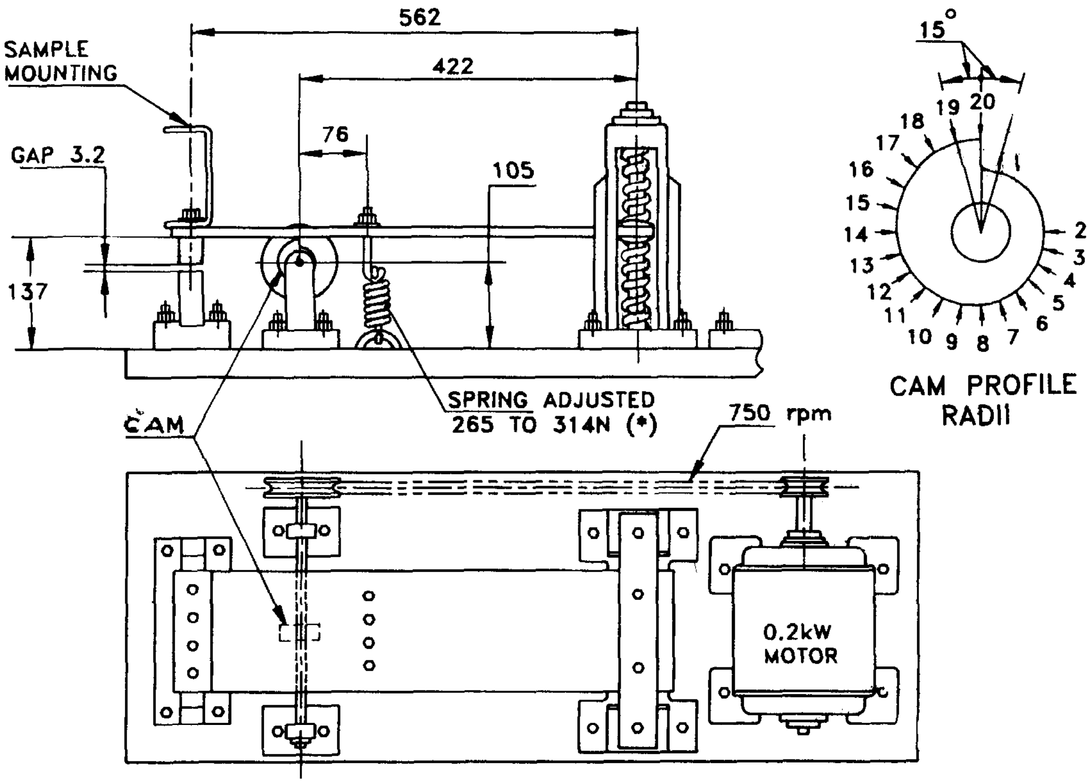
10.12 Cold Test

10.12.1 This test is intended to determine the suitability of the equipment at the specified low temperature likely to be encountered when mounted on a vehicle.

10.12.2 The test shall be conducted as specified in IS 9000 (Part 2/Sec 1) : 1977 to IS 9000 (Part 2/ Sec 4) : 1977.

10.12.3 The equipment shall be tested for low temperature use at the following conditions:

Temperature	10°C
Duration of exposure	2 hours



Cam Profile Radii (†)

Point	Radius, mm	Point	Radius, mm
1	12.70	11	15.96
2	12.70	12	16.36
3	12.92	13	16.75
4	13.19	14	17.15
5	13.58	15	17.55
6	13.98	16	17.94
7	14.38	17	18.34
8	14.77	18	18.74
9	15.17	19	18.96
10	15.57	20	19.95

*Adjusted load of spring at the stand of the shock tester.

†The cam width is to be between 13 and 25 mm.

FIG. 2 SHOCK TEST MACHINE

10.12.4 *Requirement*

After the test, reflex reflector shall be allowed to return to ambient temperature. The reflex reflector shall comply with the performance requirements (*see* **10.1.2.3**).

11 MARKING

11.1 Each reflex reflector shall be permanently and legibly marked, in such a location as to be clearly visible when the reflector is mounted on the vehicle with the following information as appropriate:

a) Indication of source of manufacture;

b) The word 'TOP' inscribed horizontally on the highest part of the illuminating surface if such as indication is necessary to determine without ambiguity the mounting position recommended by the manufacturer; and

c) The size and colour of reflex reflector.

11.2 The markings shall be placed on the transmitting surface, or one of the transmitting surfaces of the reflex reflecting device.

12 PACKING

Reflex reflectors shall be suitably packed to guard against damage during transportation. The reflectors may be packed in cartons of 10 or 20.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Automotive Accessories and Garage Equipment Sectional Committee, TED 9

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